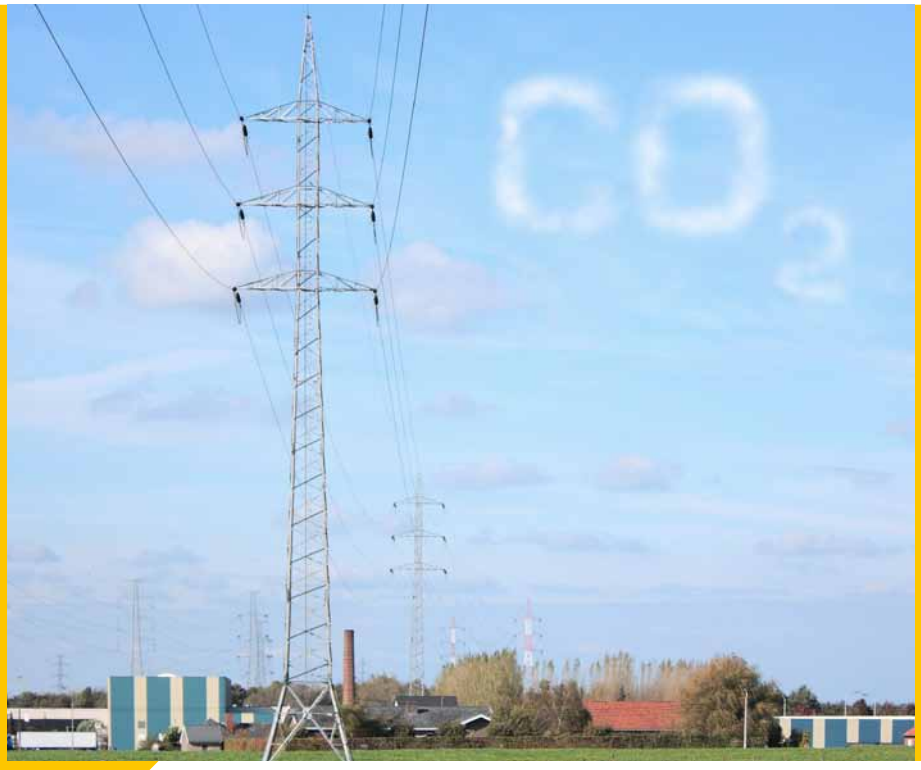
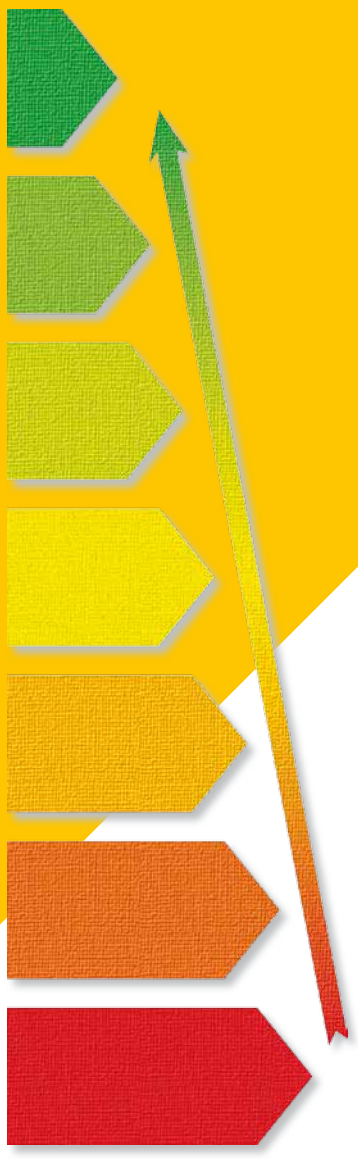
# EnergyMaster



## Energy monitoring results in huge cost savings and reduces carbon footprint

For decades, the textile industry has applied the principles of process monitoring to their production machines. As such, textile machines are networked to MES (Manufacturing Execution System) systems to monitor in real time production, quality, speed, stop levels, downtimes and production efficiency.

Today it is no longer sufficient to optimize output, quality and production planning, also energy consumption is becoming a very important factor in the operating cost of a textile plant. A sudden increase in the energy consumption of a production run can push an order easily in the red figures. With ever rising energy prices and increasing environmental legislation, efficient energy management has become a very critical success factor to run a profitable business in today's global economy.

In order to help textile companies with these new challenges, BMSvision has extended its existing MES applications with an **EnergyMaster** module. Following the principle of Monitoring and Targeting (M&T), it maps the different energy consumptions (electricity, gas, compressed air, water, steam, effluent, $CO_2$ emission) for further analysis and optimization. The integration of these energy parameters with the other MES applications, such as monitoring of spinning, weaving, dyeing and finishing machines provides a perfect insight in the relation between energy consumption and production.

Continuously monitoring the energy consumption creates an "energy awareness culture" amongst all employees within the company. **EnergyMaster** is the perfect tool for a company to achieve its Energy Efficiency Plan goals.

# Which objectives are targeted with EnergyMaster?

By monitoring the energy consumption, the company gets answers on important questions such as:

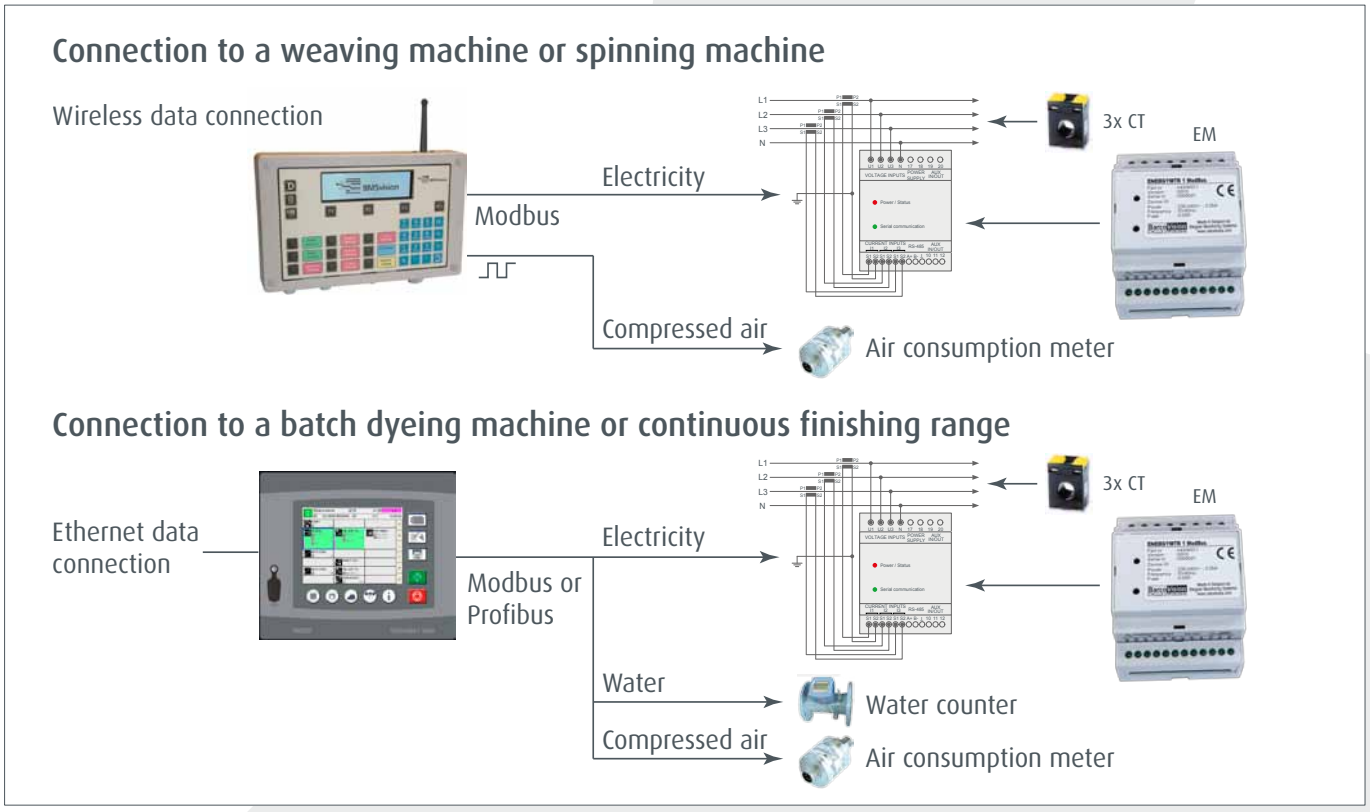
- Which machines or departments are the largest energy users?
- What is causing our peak consumption?
- What about the power factor (cos phi) of our company?
- What about the energy consumption fluctuation of a machine or department over time?
- What is the energy consumption or cost by production order and product?
- What is the remnant energy consumption when production is shut down (base load)?
- What abnormal consumptions occur and when?

## Measuring energy consumption

In order to achieve energy monitoring, consumption meters need to be installed. In some departments, meters can be placed in the power switch panel to monitor the consumption of a department or group of machines, but in case a detailed follow up or correlation with production output is required, the individual machines should be equipped with meters.

In spinning and weaving, electricity and compressed air are by far the most important energy resources. In dyeing and finishing, also water, gas and steam are important energy cost factors.

Energy consumption meters are connected to the BMSvision Data Units either by means of pulse outputs, Modbus or Ethernet communication. In many cases, these Data Units are already present at the machine to detect and transmit production and quality data to the BMSvision MES-system. As such, energy data can be transmitted via the existing (wired or wireless) network to the server of the BMSvision system. The Backup & Recovery feature ensures that no data is lost in case of network or server failures.




▲ Fig. 1: A Data Unit can be extended with an energy meter. The production and quality data of the machine are passed on together with the energy consumption data to the BMSvision MES system. In the dye house, Sedomat controllers are used for process control; these can also be extended with meters for power, compressed air and water consumption

## Energy consumption meters and counter sources

The BMSvision range of energy consumption meters includes:
- Three types of electricity meters.
- Air flow meter.
- Temperature and humidity sensor.

For the electricity meters (EM), bar, cable-through or split core current transformers (CT) are available for different conductor sizes and currents up to 5000 A.

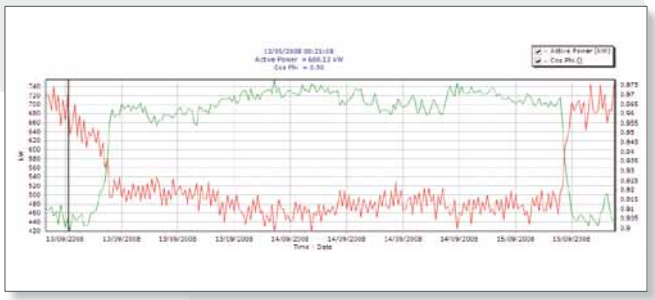
Meters that are already available in the plant can also be connected, provided they are equiped with pulse outputs, Modbus or Ethernet interface. Counter data can also be imported from manual meter recording or other sources through a spreadsheet, XML-file or OPC interface.

# Reporting energy consumptions

EnergyMaster comes with a powerful and flexible report generator. With the "create once, use always"-principle, each user can define his own set of reports needed for the analysis and follow up of the various consumptions in the different departments. The 'dashboard' allows the visualization of reports, graphs and graphical meters from any computer with web access. EnergyMaster includes a set of predefined types such as:

### Counter overview report

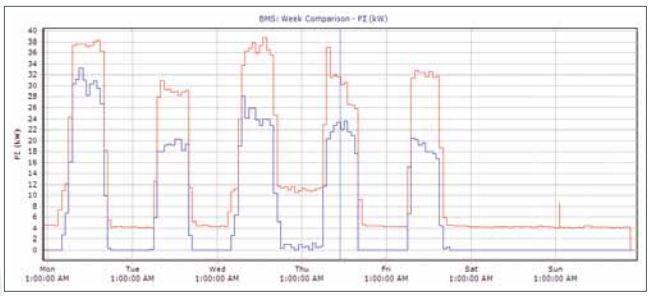
These are graphs which map the meter data in a graphical way. With such report type, the main meter of the plant or a department can be monitored to trace abnormal peak consumption, to eliminate abnormal consumption and for example to evaluate if reduced night or weekend shifts make sense, considering the higher energy consumption per unit of production.



▲ Fig. 2: Counter overview report of the main meter of the plant. The electricity consumption (active power) and the according power factor (cos phi) are reported every 15 minutes. During the weekend, fewer machines are in production and as a result the active power decreases and the power factor improves. The graph shows that the power factor always remains above 0.9, which indicates an acceptable situation. This graph also allows to evaluate the functioning of the condenser battery for improvement of the power factor.

### Period comparison report

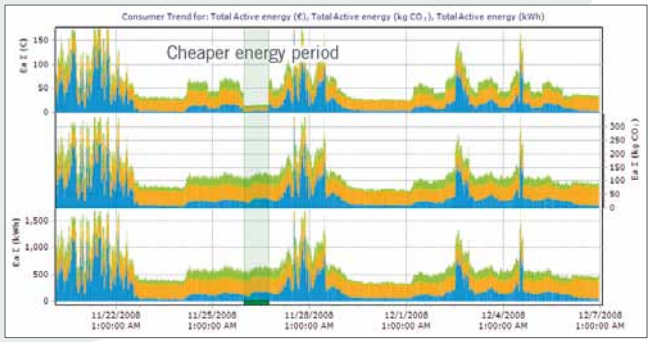
Helps to compare the energy consumption over similar periods. A reference period is taken to compare with the consumption of other periods. Such comparison is especially useful to easily see the consequences of improvement projects and to detect abnormal consumption.



▲ Fig. 3 This period comparison report shows that the heating was not switched off during certain nights.

### Consumer trend report

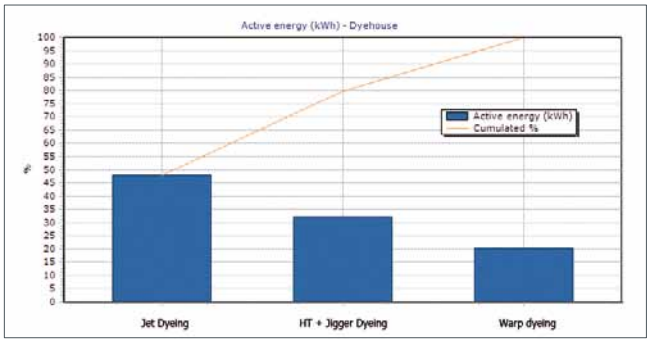
Is used for the analysis of the energy consumption for various consumers. This way one can analyze how the energy consumption, $CO_2$ emission and cost varies in time in one single 3C-report.




▲ Fig. 4: Consumer trend report showing the stacked consumption, $CO_2$ emission and cost of three consumers. The cost graph (top) shows a lower cost during the silent hours or while an energy block has been bought, despite the same consumption.

### Consumer report

Shows the consumption of a specific energy or utility resource by department, work center or machine over a certain time period. These reports allow to quickly identify the "top consumers" for a selected energy resource. Different chart types are possible, like a pie chart or pareto chart.




▲ Fig. 5: Consumer (pareto) report.

# Alarming

Automatic alerts via e-mail or text messages on exceptional energy consumption or consumption anomalies, allow for a quick reaction and to realize immediate savings by solving the problem already in an early stage. An alarm can set a Data Unit output or OPC tag to automatically shut-off consumers. Alarm escalation can be used to report alarms that were not handled within the specified time.

# Production related reporting and energy monitoring standards

EnergyMaster integrates seamlessly with the BMSvision production monitoring systems. Combining production data with energy consumption data is a powerful tool that allows evaluating the energy component in the overall production cost of each product. The energy consumption can be displayed on the Data Units on the production floor, which makes the operator aware of the energy consumed.

Furthermore, the energy consumption reports can be perfectly integrated in the monitoring application. From the real time monitoring screen, the user can follow all energy consumptions (electricity, compressed air, ...) in real time.

Reporting of energy consumption related to production output is well documented by industry standards. EnergyMaster contains a full set of industry standard reports, such as the PCL, SEC and CUSUM charts:

### PCL: Performance Characteristic Line

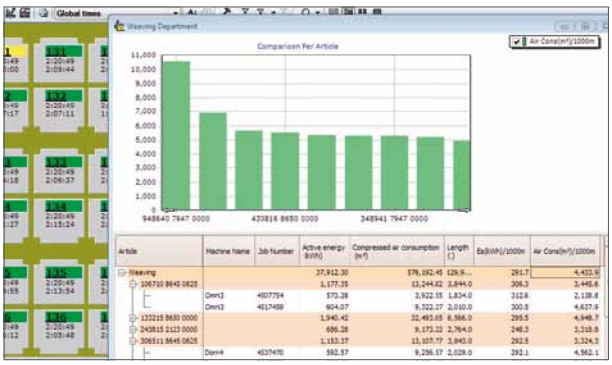
The PCL is the result of a regression analysis between energy consumption and production output, as registered by the monitoring system. It can be plotted for one machine, a machine group or a complete department or plant and for any energy resource monitored by the system. Based on this regression analysis, the base load is calculated, which is the energy consumed when there is no production at all. The slope of the line indicates the amount of energy needed to produce one unit of product.

### SEC: Specific Energy Consumption

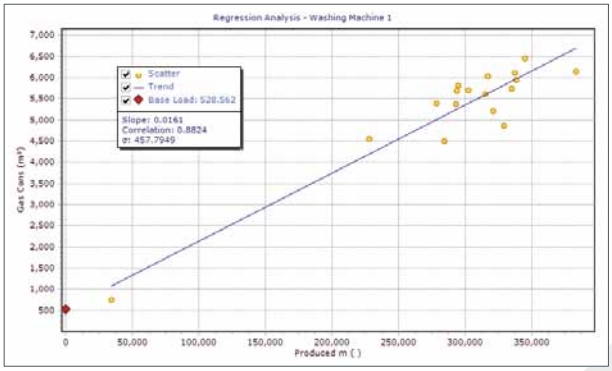
A next graph of importance is the SEC, which stands for Specific Energy Consumption in terms of energy used per unit of production output (for example: m³ compressed air/100000 picks). A typical chart is the monthly evolution of the SEC, which allows to check whether the plant is improving on energy efficiency.

### Monitoring & Targeting

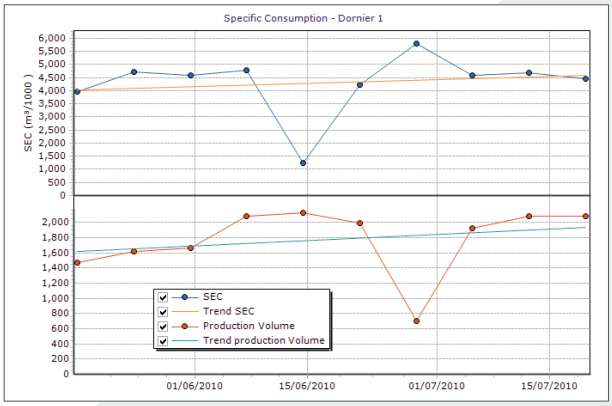
The CUSUM trend (Cumulative Sum) is a special report type that allows comparing the real consumption vs. budget. The gradient line in the trend graph allows immediate detection of a rising or decreasing trend in energy consumption.



▲ Fig. 6: PlantView with EnergyMaster report (energy consumption comparison per article).




▲ Fig. 7: Performance Characteristic Line (PCL) for the gas consumption of a washing machine.




▲ Fig. 8: Evolution of the Specific Energy Consumption (SEC), air consumption of a Dornier loom.

▲ Fig. 9: Energy consumption comparison by article.

# Conclusion

With the addition of the EnergyMaster module, the BMSvision WeaveMaster systems are extended with the monitoring of an important cost factor. By taking advantage of the already present data collection network, database and server configuration, the investment cost can be kept to the minimum while the monthly energy bill savings can be substantial by using the EnergyMaster module.

By defining an Energy Efficiency plan with clear objectives, significant energy savings can be realized. EnergyMaster is the right software package to provide analysis and decision support for quick energy saving actions while insuring a short ROI time.

BMSvision

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